

What is claimed is:

1. A hopper closure assembly for opening and closing a discharge opening in a hopper containing granular material, the hopper closure assembly comprising:

a gate frame surrounding the discharge opening;

5 a gate moveably mounted to the gate frame from a closed position in covering relation over the discharge opening to an open position uncovering at least a portion of the discharge opening for removal of the granular material through the discharge opening;

the gate having a leading edge that moves across the discharge opening when the gate

10 moves between the open and closed positions;

a raising structure that engages and raises the leading edge of the gate when the gate moves to the closed position and that lowers the leading edge of the gate when the gate moves away from the closed position toward the open position.

15 2. The hopper closure assembly of claim 1 wherein the gate utilizes a weight force of the granular material acting on the gate to assist in movement down the raising structure

3. The hopper closure assembly of claim 1 wherein the raising structure is a ramp.

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4. The hopper closure assembly of claim 1 wherein the leading edge has an attached angled member and the gate frame has a receiving edge that accepts the angled member.

5. The hopper closure assembly of claim 1 further comprising a closure mechanism  
25 mounted on the gate frame to move the gate for opening and closing the discharge opening.

6. The hopper closure assembly of claim 5 wherein the closure mechanism has a rotatable member;

an elongated arm having a secured end fixed for rotation with the rotatable member of the  
30 closure mechanism and a free end extending alongside the gate frame;

a guideway attached to the gate having a toothed face and a smooth face, the guideway toothed face resistively engaging the rotatable member so rotation of the rotatable member moves the guideway longitudinally;

a raceway mounted on the door frame;

- 5 a roller wheel attached to the door forward the leading edge and rollingly engaging the raceway;

roller wheels attached to the door frame and rollingly engaging the guideway smooth face.

7. The hopper closure assembly of claim 6 wherein the door frame has opposing side  
10 edges and opposing forward and rear edges; the raceway being mounted on the opposing side edges.

8. A hopper closure assembly for opening and closing a discharge opening in a hopper containing granular material that by gravity has a weight force extending toward the  
15 discharge opening, the hopper closure assembly comprising:

a gate frame surrounding the discharge opening;

- a gate moveably mounted to the gate frame from a closed position in covering relation over  
the discharge opening to an open position uncovering at least a portion of the  
discharge opening for removal of the granular material through the discharge  
20 opening;

the gate having a leading edge that moves across the discharge opening when the gate moves between the open and closed positions;

- the leading edge having an angled member that angles away from the discharge opening  
and the granular material within the hopper, whereby the weight force of the  
25 granular material engages the angled member during movement of the angled member from the closed position to the open position and includes a horizontal component force that is in the direction of movement of the gate from the closed to the open position.

- 30 9. The hopper closure assembly of claim 8 further comprising a raising structure that engages and raises the leading edge of the gate when the gate moves to the closed position

and that lowers the leading edge of the gate when the gate moves away from the closed position toward the open position.

10. The hopper closure assembly of claim 8 wherein the gate has a following edge  
5 opposite the leading edge, the leading edge approximately level with the following edge.

11. The hopper closure assembly of claim 8 wherein the angled member is L-shaped  
and the gate frame has a receiving edge that accepts the L-shaped leading edge.  
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12. The hopper closure assembly of claim 10 further comprising a raising structure  
attached to the gate frame that lifts the leading edge of the gate relative the following edge.

13. The hopper closure assembly of claim 12 wherein the gate pivots upwardly from the  
15 following edge.

14. The hopper closure assembly of claim 12 wherein the leading edge of the gate is  
adapted to move downward from the raising structure to assist in opening the discharge  
opening.  
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15. A hopper closure assembly for opening and closing a discharge opening in a hopper  
containing granular material, comprising in combination:  
a gate frame engaging the discharge opening;  
a gate operably mounted in the gate frame for longitudinal and vertical movement;  
25 a leading edge on the gate adapted for vertical movement;  
a raceway upon the gate frame permitting longitudinal movement of the gate; and  
a raising structure within the raceway permitting vertical movement of the leading edge.

16. The hopper closure assembly of claim 15 wherein the raising structure is a ramp.  
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17. The hopper closure assembly of claim 15 wherein the gate has a following edge opposite the leading edge, the following edge maintained approximately parallel the longitudinal axis when the leading edge is raised.

5 18. The hopper closure assembly of claim 15 wherein the leading edge of the gate is adapted to move downward from the raising structure to assist in opening the discharge opening.

10 19. A method of opening a hopper closure assembly having a hopper containing granular material and a discharge opening below the granular material whereby the granular material by gravity has a weight force directed toward the discharge opening, the method comprising:

moving a gate having a leading edge from a closed position wherein the gate covers the discharge opening to an open position wherein the gate opens the discharge opening  
15 to permit the granular material to move through the discharge opening;  
angling an angled portion of the leading edge of the gate away from the discharge opening whereby the weight force of the granular material acting on the angled portion will exert a horizontal component force on the gate in the direction of movement of the gate from the closed to the open position.

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20. The method of claim 19 further comprising providing a raising structure upon the gate frame to elevate the leading edge of the gate, permitting the leading edge to move from the receiving edge by descent from the raising structure.

25 21. A method of opening a hopper closure assembly having a hopper containing granular material and a discharge opening below the granular material whereby the granular material by gravity has a weight force directed toward the discharge opening, the method comprising:

moving a gate having a leading edge from a closed position wherein the gate covers the discharge opening to an open position wherein the gate opens the discharge opening  
30 to permit the granular material to move through the discharge opening;

guiding the leading edge of the gate in a direction away from the discharge opening during movement of the gate from the closed to the open positions;  
providing a raising structure upon the gate frame to elevate the leading edge of the gate, permitting the leading edge to move from the receiving edge by descent from the raising structure.

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22. The method of claim 21 further comprising the step angling an angled portion of the leading edge of the gate away from the discharge opening whereby the weight force of the granular material acting on the angled portion will exert a horizontal component force on the gate in the direction of movement of the gate from the closed to the open position.

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23. A method of opening a hopper closure assembly, comprising  
providing a hopper containing granular material and a discharge opening below the granular material whereby the granular material by gravity has a weight force directed toward the discharge opening;  
providing a longitudinal sliding gate which parallels a plane defined by the discharge opening;  
moving a gate having a leading edge from a closed position wherein the gate covers the discharge opening to an open position wherein the gate opens the discharge opening to permit the granular material to move through the discharge opening;  
interacting the granular material with the gate to assist in movement;  
guiding the leading edge of the gate in a direction away from the discharge opening during movement of the gate from the closed to the open positions.

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24. The method of claim 23 further comprising providing a raising structure upon the gate frame to elevate the leading edge of the gate, permitting the leading edge to move from the receiving edge by descent from the raising structure.

25. The method of claim 23 further comprising angling an angled portion of the leading edge of the gate away from the discharge opening whereby the weight force of the granular material acting on the angled portion will exert a horizontal component force on the gate in the direction of movement of the gate from the closed to the open position.

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